Failure Analysis of Geothermal Water System Components

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Background

The Boise Warm Springs Water District geothermal water system experienced isolated component failures, each of which forced a shutdown of the system and/or caused damage to homes. These failures preempted the components’ expected expirations and appeared to be corrosion-induced, motivating an investigation into this hypothesis and preventative measures.

Methods

- Electrochemical Tests
  - Potentiodynamic Behavior
  - Pitting was evident in braze material
  - Linear Potential
  - Alternative braze materials might be more effective

- Chemical Analysis
  - Photoluminescence
  - ICP-MS
  - Alternative methods for analysis

- Optical Microscopy
  - Scanning Electron Microscopy (SEM)
  - Energy-Dispersive X-Ray Spectroscopy (EDS)

- Failure Analysis
  - Electrochemical testing
  - Thermocycling
  - Metallography

Results

- Corrosion Behavior
  - Micromechanical behavior
  - Elemental composition

- Surface Analysis
  - XRF
  - EDX

Discussion

- Geothermal Water
  - Oxide
  - Sulfide
  - Copper

- Discussion
  - Microstructure
  - Corrosion mechanisms

Conclusions

- Failure Analysis
  - Pitting
  - Corrosion

Acknowledgements

Boise Warm Springs Water District, Del Eyrichson, Pete Miranda, Mike Hurley, Marion Lytle, Harold Ackler, Undergraduate Materials Lab, Boise State Center for Materials Characterization

References

[4] Sulfide

Images:

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<table>
<thead>
<tr>
<th>Sample</th>
<th>Ecorr (milliVolts vs. Saturated Calomel Electrode)</th>
<th>EC (milliVolts vs. Saturated Calomel Electrode)</th>
<th>pH</th>
<th>SEM Analysis</th>
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<td>Not Tested</td>
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<td>Backscatter</td>
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</table>

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